

Buffam R06  
2614

174

UNITED STATES DEPARTMENT OF AGRICULTURE

# FOREST SERVICE

PACIFIC N. W. FOREST AND RANGE EXPERIMENT STATION

## PROGRESS REPORT

COLONIZATION IN OREGON AND WASHINGTON  
OF APHIDOLETES THOMPSONI - AN EUROPEAN  
PREDATOR OF THE BALSAM WOOLLY APHID

By

K. H. Wright, Entomologist

and

R. G. Mitchell, Entomologist



Division of Forest Insect Research  
Pacific Northwest Forest & Range Experiment Station  
Portland, Oregon  
Feb. 1, 1958

M-5123

U. S. GOVERNMENT PRINTING OFFICE

8-7417

This report is not for publication in whole or in part without prior approval of the chief of this Bureau.

# TABLE OF CONTENTS

	Page
INTRODUCTION .....	1
COLLECTION AND SHIPMENT .....	1
REARING METHODS .....	5
Rearing Boxes and Emergence Vials .....	5
Provisions for Moisture and Light .....	7
Temperature in the Rearing Room .....	9
Collecting and Storing Emerged Predators .....	9
Scheduling Colonies for Field Release .....	10
RESULTS OF REARING .....	13
Volume and Period of <u>Aphidoletes</u> Emergence .....	13
Factors Affecting <u>Aphidoletes</u> Emergence .....	14
Emergence of Parasites and Other Insects .....	16
COLONIZATION .....	17
Transportation to Release Points .....	17
Release .....	17
Host Conditions at Time of Release .....	20
OBSERVATIONS AND RECOMMENDATIONS .....	22
Observations .....	22
Recommendations .....	25
PROJECT PERSONNEL .....	26
APPENDIX .....	27

## LIST OF TABLES AND ILLUSTRATIONS

Page

### Figures

1. Shipping Containers in which Aphidoletes Arrived from Europe..	2
2. Larval and Adult Stages of <u>Aphidoletes</u> .....	4
3. Cages Used for Rearing <u>Aphidoletes</u> .....	6
4. Rearing Arrangement for <u>Aphidoletes</u> at Sellwood Laboratory ...	8
5. Isolation Cage for Handling Parasites .....	11
6. Aspirating Equipment for Removing Parasites .....	12
7. Ice Chests for Transporting Predators .....	18
8. Releasing <u>Aphidoletes</u> in the Field .....	19

### Tables

Table 1. - Summary of <u>Aphidoletes thompsoni</u> Rearings .....	28
Table 2. - Summary of Proctotrupid Parasite Emergence .....	29
Table 3. - Summary of <u>Aphidoletes thompsoni</u> Releases .....	30

### Graphs

1. Trend of Total <u>Aphidoletes</u> Emergence .....	31
2. Trend of Emergence of Male and Female <u>Aphidoletes</u> .....	32
3. Trend of Emergence of Proctotrupid Parasites .....	33

COLONIZATION IN OREGON AND WASHINGTON  
OF APHIDOLETES THOMPSONI - A PREDATOR OF  
THE BALSAM WOOLLY APHID

By

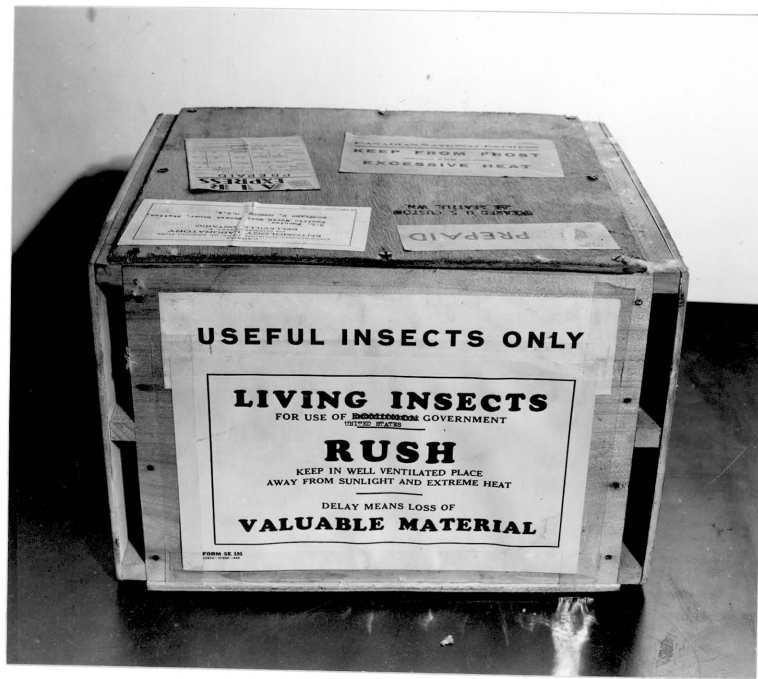
K. H. Wright  
and  
R. G. Mitchell

INTRODUCTION

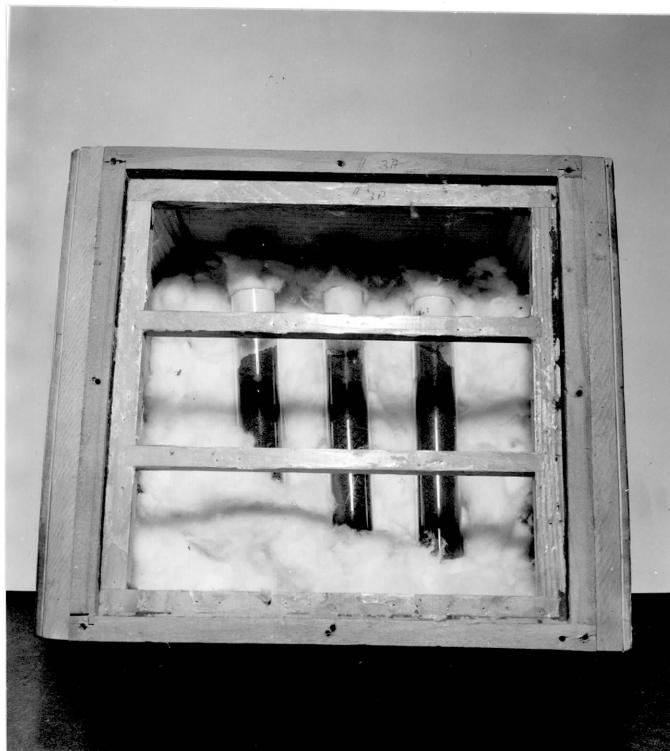
During July 1957, some 1800 Aphidoletes thompsoni Moehn (Diptera: Itonididae), an European predator of the balsam woolly aphid, were released in western Oregon and Washington. The predators were provided by the Canadian Department of Agriculture, Science Service, through arrangements made by the U.S. Forest Service and the Agricultural Research Service of the U.S. Department of Agriculture. The following report describes the details concerning the shipment, rearing and release of the insects.

COLLECTION AND SHIPMENT

Arrangements for collection of the predators was made by the Canadian-financed Commonwealth Institute of Biological Control in Europe. Actual collection of the insects was made about mid-June by Dr. H. Zwölfer at Cemjata, near Presov in eastern Slovakia. The insects, estimated at 47,850, were sent from Vienna, Austria, by Dr. L. P. Mesnil of the Institute to the Canadian Science Service entomology laboratory at Belleville, Ontario for inspection and further distribution. An estimated 10,000 of the predators were separated for shipment to the Pacific Northwest Forest and Range Experiment Station and the balance sent to the Canadian Forest Biology laboratory at Fredericton, New Brunswick.



A.



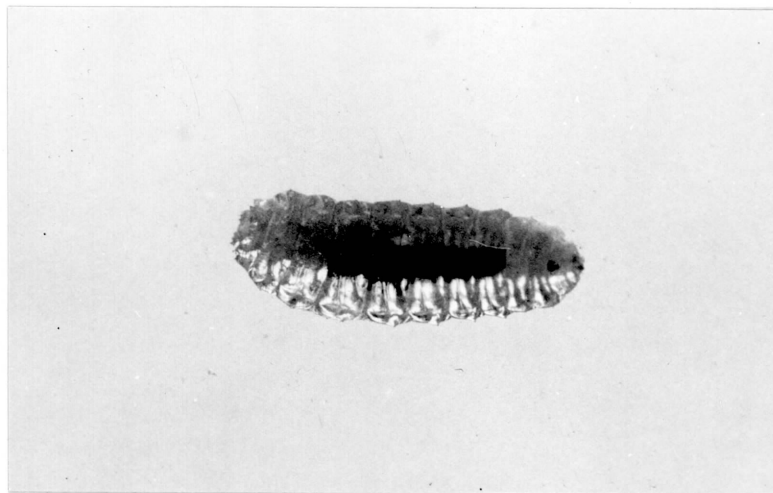
B.

Figure 1. - (A) Shipping box in which Aphidoletes thompsoni arrived from Europe via Canada; (B) inside of box showing vials containing soil and predators.

The Oregon shipment is believed to have left Belleville by train on June 29 for Toronto where it was placed on Trans-Canada Airlines to Vancouver, British Columbia. At Vancouver it was transferred to United Airlines flight 674, which arrived at Portland at 12:49 p.m. on July 1. By special arrangement the predators were allowed to pass through U.S. Customs at Seattle without detailed inspection.

The shipment was taken immediately to the Sellwood laboratory in Portland and unpacked. The 10,000 insects were contained in a mixture of sandy-loam soil in 4 shell vials, each about 7/8-inch in diameter and 6 inches long. The vials were plugged with cotton stoppers, well wrapped in the same material and packed in a sturdy wooden box commonly used by the Commonwealth Institute of Biological Control for shipping live insects (See Fig. 1). Although no ice was present in the box, the vials and contents were damp and cool. It was felt that the shipment had arrived in good condition, although apparently held up enroute for several hours by poor airline connections or other unknown reasons.

On examination of the predators it was noted that a large number of them were still in the larval stage and were moving about actively. A considerable number of larvae were wedged between the cotton plugs and the sides of the vials. A sample of the soil and insects was taken to check on the life stages present; it was estimated that about 70 percent were in the larval or pre-pupal stages and the balance in the pupal stage. The larvae (Fig. 2) were measured as being approximately 2 mm. long, and the puparia 1.5 mm.



A.



B.

Figure 2. - Aphidoletes thompsoni Moehn. (A) Prepupal larva;  
(B) Adult (female).

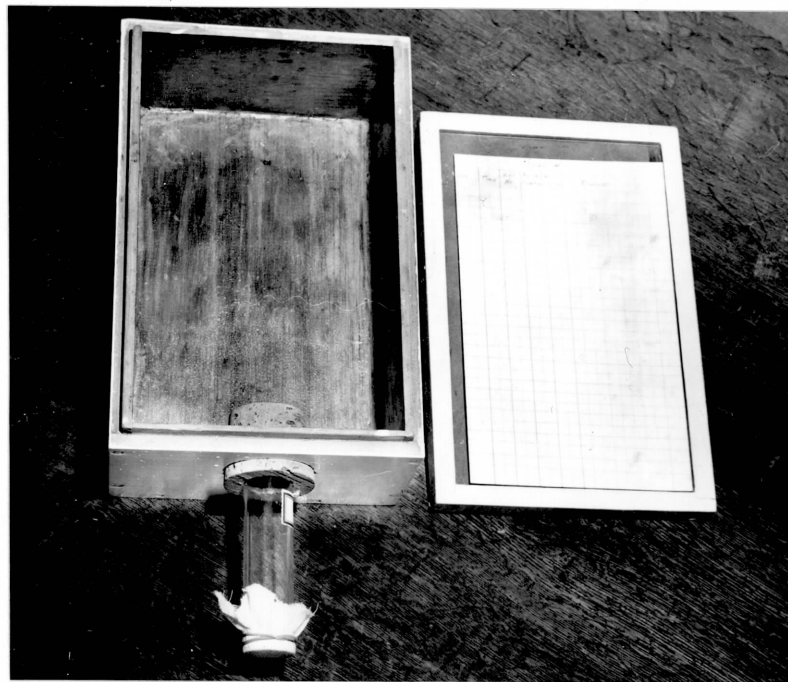
## REARING METHODS

### Rearing Boxes and Emergence vials

The mixture of soil and Aphidoletes was transferred to 16 cages, representing 2 different types as follows.

Ten of the cages were glass-topped Melrose boxes 6 x 10 x 4 inches high, each fitted with one 4-inch 25 mm. open-end shell vial (Fig. 3A). The exposed open end of the vial was covered with muslin cloth and secured with a rubber band. To prevent condensation on the glass lids of the boxes and to insure more uniform humidity, the bottoms and tops of the cages were lined with heavy blotting paper.

The other type cage used was the standard white, wax-lined ice cream carton (Fig. 3B). Of these, 4 were pint-size and 2 were quarts. These were also fitted with 4-inch shell vials.



A.



B.

Figure 3. - (A) Melrose-type rearing box, emergence record form, and emergence vial; (B) quart-size, ice cream cartons in wet sand used for rearing Aphidoletes.

### Provisions for Moisture and Light

The Melrose boxes and pint-size ice cream containers were placed on a laboratory shelf about 4 feet high. The former were placed so that the emergence vials were horizontal; the latter were placed on end with the vials pointing vertically (Fig. 4). The quart ice cream containers were laid on their sides in damp sand in a large sand table, with the emergence vials in horizontal position.

In an attempt to insure more uniform humidity in the Melrose boxes, the soil containing the insects was first placed in metal pill-box lids 3 inches in diameter and 1/2-inch deep. It was soon noted, however, that the soil tended to "set" in a hard mass and mold began to grow on it. As the result, the soil was spread out on the floor of the boxes, as had been done in the ice cream containers.

Except for those cages in the sand table, moisture was added throughout the rearing period. A fine-spray bulb-type atomizer was used, and amounts varying from one squeeze per 8 hours to 3 per 4 hours was applied. Whenever moisture began to condense on the vials, the frequency was reduced. Most moisture was added on the warmest days. Before emergence became heavy, the boxes were opened frequently to check on moisture conditions.

For the "bank" of 14 cages shown in Figure 4, two hinged desk lamps containing two 20-watt fluorescent tubes were used to draw off the emerging Aphidoletes. A common 60-watt goose-neck desk lamp was used with the cages in the sand table.

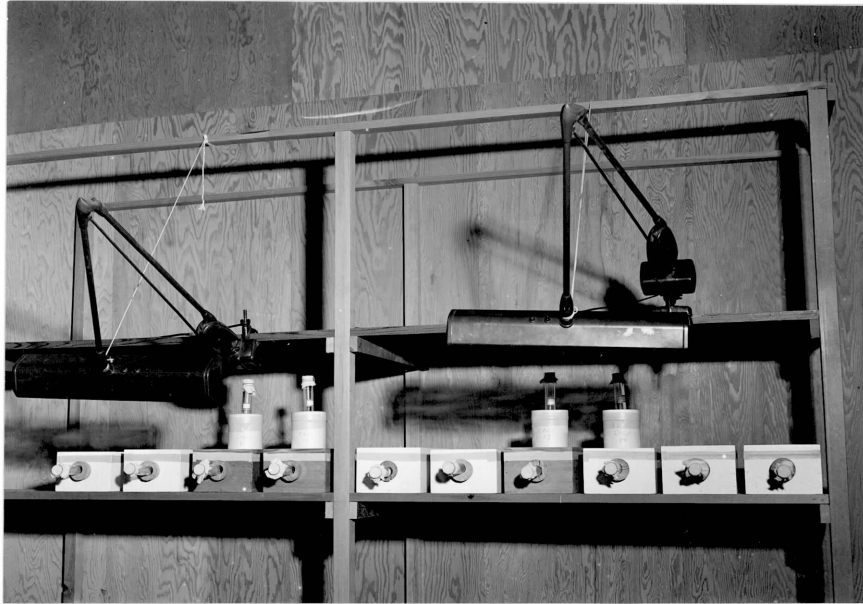


Figure 4. - Rearing arrangement of Aphidoletes material at Sellwood Laboratory.

### Temperature in the Rearing Room

Early in the rearing period, which extended from July 1 to 22, temperatures in the rearing room varied from 60° at night to about 70° F. in the daytime. During the height of the emergence, however, hot weather occurred and temperatures varied from about 72° to a high of 80° on July 19. Because the laboratory building is of brick construction, the temperature varied little from night to day during the hot weather. No facilities existed for lowering the temperature, which was regarded as being higher than desirable.

### Collecting and Storing Emerged Predators

When about 5 or more predators had emerged into the vials, they were removed from the cage by quickly removing the vial, stoppering it temporarily with one's thumb and replacing it with an empty one. When emergence was heavy, this operation required rapid movement on the part of the collectors; even so, a few Aphidoletes escaped. These, however, usually lit on the relatively cool fluorescent light tubes and could be recollected.

The vials of emerged predators were stoppered with cotton plugs and held to the light, where a count, by sexes, could be made. Sexing in this manner proved to be simple because the longer and more definitely stalked antennae of the males, curving back over the head like a ram's horns, were easily recognizable. Also, the abdomen of the females was usually considerably larger than the males. Frequently the anal claspers on males were visible to the naked eye.

A very small black proctotrupid parasite (probably Aphognamus sp.) frequently emerged with the predators. To remove and destroy these parasites, the vials were taken to a walk-in isolation cage (5' x 5' x 6') covered with 32-mesh plastic screen (Fig. 5). There the cotton-stoppered end of the vial was replaced with a rubber cap through which a fine-pointed aspirator could be inserted (Fig. 6). The parasites were readily drawn off, and subsequently killed by sucking a small amount of chloroform into the aspirator.

After separation from their parasites, the vials of predators were stored in a standard household refrigerator at 42°-45° F. A somewhat higher temperature was desired but could not be secured with the available refrigerator. It was found, however, that Aphidoletes was quite active at the storage temperature used. They were observed to walk about briskly when disturbed and were even capable of short flight. When undisturbed, they were very quiet, which was regarded as desirable.

#### Scheduling Colonies for Field Release.

The frequency with which colonies of Aphidoletes were taken into the field was determined by two factors -- the length of time since emergence, and the number available. Early in the rearing period, emergence was slow and it sometimes took 36 to 48 hours to secure even a small colony. Because it was regarded as important to get them into the field as soon as practicable after emergence, as few as 28 were colonized at a time. During the height of emergence, some of the predators were taken out for release within 12 to 18 hours of collection.

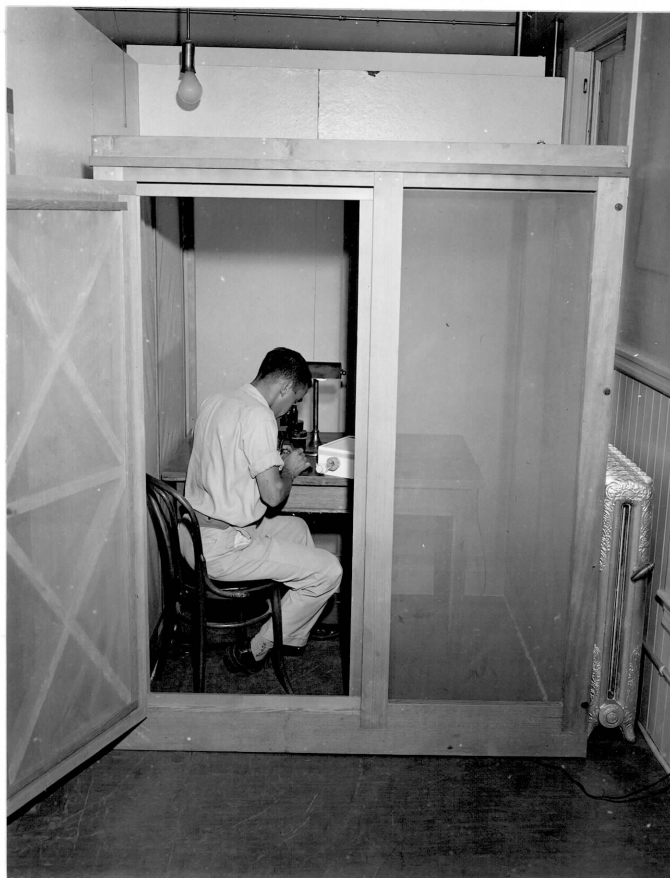
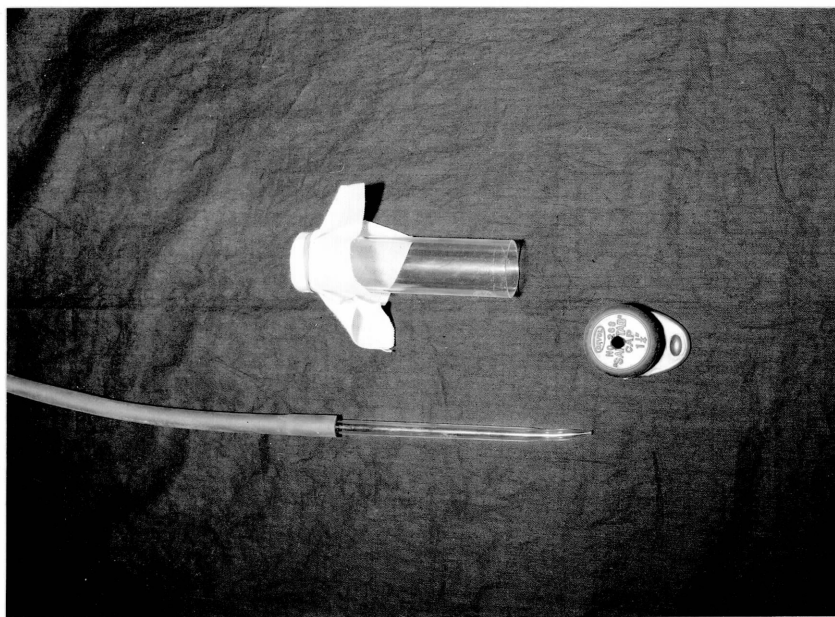
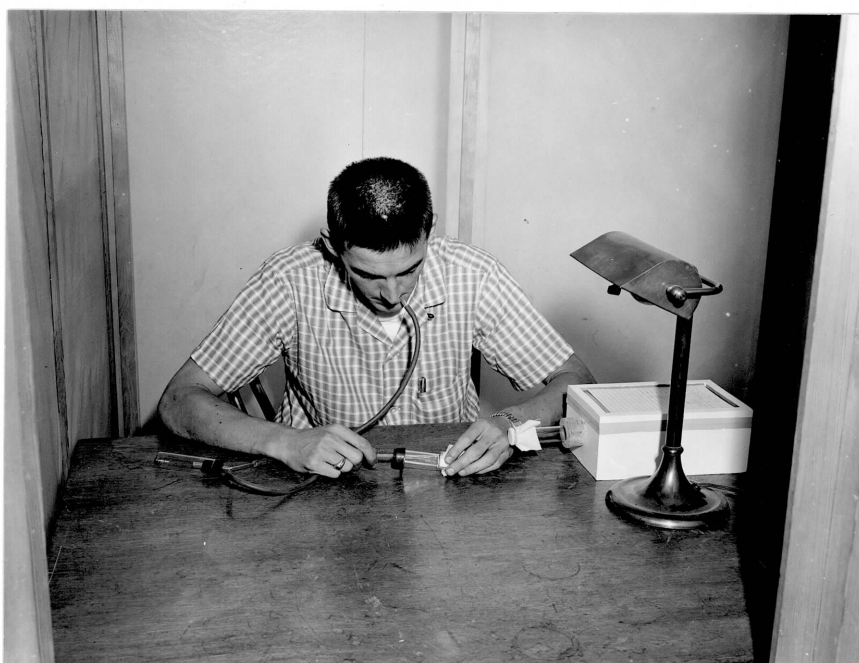


Figure 5. - Isolation cage used when handling vials containing parasites.



A.



B.

Figure 6. - (A) Aspirator used for removing proctotrupid parasites from emergence vials; (B) entomologist R. G. Mitchell aspirating proctotrupids in isolation cage.

## RESULTS OF REARINGS

### Volume and Period of Aphidoletes Emergence.

During the period July 1 to 22, a total of 2117 Aphidoletes emerged from the rearing cages (Table 1). Of this total 737 were males and 1380 were females, a ratio of 1:1.9.

Daily emergence of both males and females during the rearing period July 1 - 22 is shown in graph 1; it is shown separately for males and females in graph 2. As can be seen, the high point of emergence was reached on July 12. Males and females emerged at essentially the same time, although at certain hours on some days there were "surges" of almost pure males or females. The reasons for this occurrence are unknown.

The total emergence figure of 2117 includes all Aphidoletes that emerged from the cages. Of this total, 287 did not live to be colonized. Mortality or loss occurred in the following principal ways: (1) In the emergence vials, particularly near the end of the emergence period when the specimens appeared to be small and weak; (2) in storage in the refrigerator; (3) escapes when removing vials from cages; (4) specimens taken for photography, mounting, and miscellaneous tests and studies; and (5) in transit to the field release points.

### Factors affecting Aphidoletes Emergence.

Emergence was strongly affected by time of day. By far the greatest number emerged between 6 PM and midnight, with the largest surge usually from about 8 to 10 PM. This suggests Aphidoletes is strongly nocturnal by habit. Following the heavy late evening emission, emergence was usually light (Collections were made round-the-clock) until about 6 AM when another pronounced, but much smaller, surge would occur. This one usually lasted until about 8 AM. The reason for these high points of emergence was particularly perplexing because, as mentioned earlier, temperature and light in the rearing room varied little between night and day.

The type of rearing cage had a strong effect on emergence, as is shown in Table 1. In an attempt to evaluate this effect, the mixture of soil and insects in each cage was weighed and the emergence per gram of soil was computed. It was realized, of course, that there was no way of knowing whether the Aphidoletes were uniformly distributed throughout the soil when it was apportioned to the cages. However, the results suggest quite conclusively that box type, particularly as it affected uniformity of moisture within, strongly influenced the success of the rearings.

By far the best emergence -- an average of 31.8 predators per gram of soil -- was secured from the quart-size ice cream containers placed on their sides to a depth of about 2 inches in damp sand. Although very little moisture was added to these containers, periodic inspection during the rearing period showed the soil to be moist and friable. Presumably the Aphidoletes still in the larval stage, which made up some 70 percent of the total when caged, were much better able to complete development under these conditions. Examination of the soil in all boxes after completion of the rearing period showed that essentially no puparia failed to produce adults, but numerous dessicated larvae and prepupae were found in those boxes that had produced poorly.

As a group, the pint-size ice cream containers were the second best producers -- 10.5 per gram of rearing medium. Apparently the heavy wax coating prevented rapid loss of moisture, resulting in more uniform humidity. The Melrose boxes produced the fewest predators, 8.4 per gram, with the exception of a few of them that had been heavily lined with paraffin for some previous rearing use. Accordingly, it is believed that the poor production was due to the fluctuating moisture conditions caused by the hygroscopic nature of the bare wood of the boxes, rather than their size or shape. In regard to shape of the cages used, adults seemed to issue promptly to the light after emergence; very few dead ones were found in any of them after completion of rearing.

### Emergence of Parasites and Other Insects.

As shown in Table 2, a total of 239 adults of a proctotrupid parasite (tentatively identified by the Canadians as Aphanognus nigro-fornicatus Schick (Hymenoptera:Proctotrupidae)) emerged from the rearing cages. As previously mentioned, special precautions were taken to insure that this insect did not escape. Fortunately the parasite, which is only about 1 mm. long, emerged mostly during the day and reached its peak emergence about 5 days later than Aphidoletes (graph 3). Had its heavy emergence period coincided with that of Aphidoletes, the job of separating the two would have been sizeable. It was noted, however, that the proctotrupids were not as readily attracted from the cages by light as was Aphidoletes. Being very fast movers, they would dart out into an emergence vial, and then very quickly return to the cage for an extended period. A number of them were found dead when the remaining contents of the cages were fumigated and killed on July 22.

## COLONIZATION

### Transportation to Release Points.

After a final check to see that no parasites were present, the colonies were taken to the field by automobile in the iced boxes shown in Figure 7. Distances to the 3 release areas varied from 65 to 80 miles. Temperatures in the iced boxes on reaching the field, varied from 41° to 55° F., depending on the volume and type of ice used. Ordinary refrigerator ice cubes maintained the lowest temperatures; however, pint cartons of frozen water were more convenient and cleaner to use, but did not keep the temperature as low. On reaching the field the covers were removed from the boxes and the temperature within allowed to rise gradually. A thermometer was carried in each box to record box and air temperatures.

### Release.

The 10 colonies of predators released varied in size from 28 to 344 and were released either in screen cages, as shown in figure 8, or "free". Details of the release as to location, time of day, sex ratio of each colony, and weather conditions are shown in Table 3.

The release cages were patterned after those used in eastern Canada and were made of 32-mesh plastic screen, except for top and bottom panels of unbleached muslin which served to fit the cage to the tree. A cotton batting gasket insured a tight fit between the muslin and the tree. To hold the screen away from the tree, an eight-gauge wire hoop was inserted near the top and bottom. The cage could be opened and closed longitudinally by a zipper; however, better access for the vials of predators was provided by making a small slit in the seam below the zipper. A needle and thread was carried for resewing the seam.



Figure 7. - Iced chests and vials of Aphidoletes ready for transportation to release points.



A.



B.

Figure 8. - (A) Releasing Aphidoletes in cage on Abies amabilis at Black Rock area, Oregon; (B) Details of release cage.

The vials were inserted through the opening in the cage as shown in figure 8A, the stoppers removed, and the predators allowed to emerge as they chose. When releases were made on warm evenings, the insects took flight almost immediately. When releases were made near mid-day and when the weather was wet and cool, they sometimes did not emerge for an hour or more. Usually the vials were left in the cage and retrieved at a later time.

In making the "free" releases, the vials of predators were merely unstoppered and placed at the bases of trees harboring heavy bole infestation, and the insects allowed to leave. Care was taken to assure that they were not released under conditions of heavy rain or wind.

Live Aphidoletes were noted in the release cages for as long as 5 days after release, suggesting that they live longer than the reported 3 to 5 days.

#### Host Conditions at Time of Release.

Because of differences in elevation, aspect, stand density, etc., at the 3 release points, development of the host or prey population varied. Following is some generalized information on the nature of the host at the 3 release points during the period of release.

Toutle River Area, (mature Abies amabilis stand; 2400 ft. elevation)- Old hiemosisten adults were numerous (about 50 wax masses per square inch) and were laying eggs. Average number of unhatched eggs per mass at the first release on July 8 was 15, and both motile and settled first instar larvae were abundant. Larvae of native predators (cnemodon sp.) were causing considerable reduction in the population. When later

releases were made at this point, on July 11 and 16, the population consisted mainly of first instar larvae in diapause, but with some adults and eggs still present.

Black Rock Area (mature Abies amabilis stand; 2600 feet elevation) - On July 9 when the first sizeable release was made, the prey population on the release tree consisted mainly of first generation adults and their eggs. Motile larvae were present but only a few settled neosistens were observed. The average number of unhatched eggs per adult was 16; the maximum was 29 and the minimum 8. Population density of the living first generation adults averaged from 49 to 65 per square inch.

By the time of the last release at Black Rock, the number of hiemosisten adults, unhatched eggs, and wandering nymphs was considerably reduced. By far the bulk of the population was in diapause in the first instar stage. No second or third instar stages were found.

Corvallis Area (Pole-size Abies grandis in forestry school arboretum; 225 ft. elevation) - Only one release was made at this point, on July 13. The bulk of the prey population consisted of third generation neosistens in diapause and a few in the second instar stage. Also present in lesser numbers were some old second generation adults and their eggs. A few motile larvae were observed. Population density in the caged area was rather light, probably no more than 5 sistens per square inch of bark surface. Higher up the stem, the density was somewhat greater.

## OBSERVATIONS AND RECOMMENDATIONS

During the course of the rearing and release work, a number of miscellaneous observations and small tests were made that might be useful on future projects of this kind. Likewise, certain recommendations can be made that would likely improve the conduct and success of future projects. These are summarized in the following sections.

### Observations

1. Refrigeration at rather low temperatures appears to be highly desirable as a means of extending the life of Aphidoletes adults. Although the normal life span of Aphidoletes adults was reported to be only 3 to 5 days, it was found that test specimens were active and apparently in good condition after 14 days at 42°-45° F. Colonies kept as long as 36 hours at this temperature lived for at least 3 days after release in field cages.
2. When adequate moisture was present, free moving larvae readily constructed pupal chambers (puparia) in soil particles in the rearing boxes.
3. In the laboratory, an attempt was made to devise a box that could be used for consolidating the predators collected in the shell vials, and thus have larger cages for transporting to the field. In one side of a 5 x 5 x 10-inch Melrose box, 3 large holes were drilled to receive 25 mm. shell vials. Three vials, containing a total of 7 recently emerged Aphidoletes, were then placed in position and covered with black light-tight

sleeves. In about one-half hour, all but one female had passed into the box, which was well lighted from above. However, in reaching the confines of the relatively large box, the predators began to fly about rapidly and almost continuously. By the following morning, 4 of the 7 predators were dead and the others were almost immobile, presumably from exhaustion. It was concluded that unless the predators could be gotten into the larger box more quickly, and then inactivated by refrigeration, that this method would cause high mortality. It seems highly desirable to collect and store the insects under refrigeration as soon as possible.

4. The open-end emergence vials (covered with muslin on one end and fastened with a rubber band) that were used to collect the insects issuing from the rearing cages were unsatisfactory in 2 respects -- It was sometimes difficult to count and sex Aphidoletes that congregated in the cloth-covered end; and the tiny proctotrupids tended to burrow between the cloth and the lip of the vial, thus making necessary very close examination of every vial. If open-end vials are desirable for rearing -- and we are not sure now that they are -- they could be improved by cementing very fine screen disks to one end of the tube.

5. One advantage of using the open-end vials for colonization in the field was discovered near the end of the releases. It was found that the predators could be easily dislodged from the vials by inserting the end containing the cotton plug through a small slit in the muslin bottom of the cage, removing the plug with one hand, and then blowing lightly through the end covered with muslin. Only a slight puff of air was needed to cause the predators to fly out, apparently unharmed. This method precluded leaving large numbers of vials in the cages for extended periods.
6. A test was run to determine if the proctotrupid parasites could pass through the 32 x 32 Lumite plastic screen used to cover the walk-in isolation cage. Two 4-inch shell vials were connected by a common cork having a hole over which a piece of the screen was glued. Proctotrupids placed in one vial readily passed into the other. In future rearings, finer screen will be needed to insure that no escapes occur. The walls of the isolation cage were examined after each handling of insects, and to our knowledge no proctotrupids escaped. Even small specks of dirt were quite visible to the naked eye when they were present on the well-lighted sides or ceiling of the cage.
7. It was found that Aphidoletes larvae and pupae in the soil medium would still complete their development after being stored at 42°-45° F. for 2 - 3 weeks. A small amount of the

shipment was preserved for miscellaneous testing of this sort. Small lots placed in paper-bottom pill boxes on damp sand were consistently reared successfully. These findings suggest that shipments can be held for perhaps considerable lengths of time -- to coincide rearing with desired prey population development, or for other reasons.

### Recommendations

1. As much advance notice as possible regarding shipments of predators should be given to those doing the rearing and colonization. Details as to the species, life stage, likely degree of parasitism, special requirements of handling, exact times of arrival, quarantine and customs problems, etc., are of vital importance.
2. Until detailed tests can be made, it appears that ice cream cartons placed in damp sand should be used for rearing Aphidoletes. These conditions are especially desirable when a large part of the population is still in the larval stage.
3. It appears desirable to scatter the insect-bearing soil in the rearing cages, rather than place it in small dishes or piles. When this is done, the predators appear to emerge with less difficulty, and there is also less danger of fungus development.

4. Aphidoletes should be collected as soon as possible after emergence and then stored at 40° to 45° F., thus preserving their energy for flight and mating after release.
5. Larger emergence containers should be designed that will hold up to 50 or 100 predators. The rather tedious and cumbersome method of using 4-inch shell vials is slow, allows some escape, and is somewhat inconvenient when releasing in the field. Any new method, however, must provide for prompt tranquillizing of the insects, either by refrigeration or other means. It must also provide means for separating parasites and other undesired organisms that may emerge.
6. On future projects, provision should be made in advance for making a complete photographic record of the undertaking, including the predators, parasites, laboratory and field equipment, and techniques.

#### PROJECT PERSONNEL

Project was under the general supervision of entomologist K. H. Wright, who also assisted in the rearing and colonization. Entomologist R. G. Mitchell had responsibility for the laboratory rearing and field releases; he was assisted by Forestry Aid P. E. Buffam, who designed much of the special equipment used. Biological Aid D. K. Costello assisted on construction and photography of equipment and facilities. Entomologist P. W. Orr photographed the insects. Field releases were made by Buffam, Mitchell and Wright, assisted by N. E. Johnson, entomologist of Weyerhaeuser Timber Company, and Dr. J. A. Rudinsky, Associate Professor of Entomology at Oregon State College.



Table 2.-Summary of proctotrupid parasite rearings at Sellwood laboratory -- July, 1957

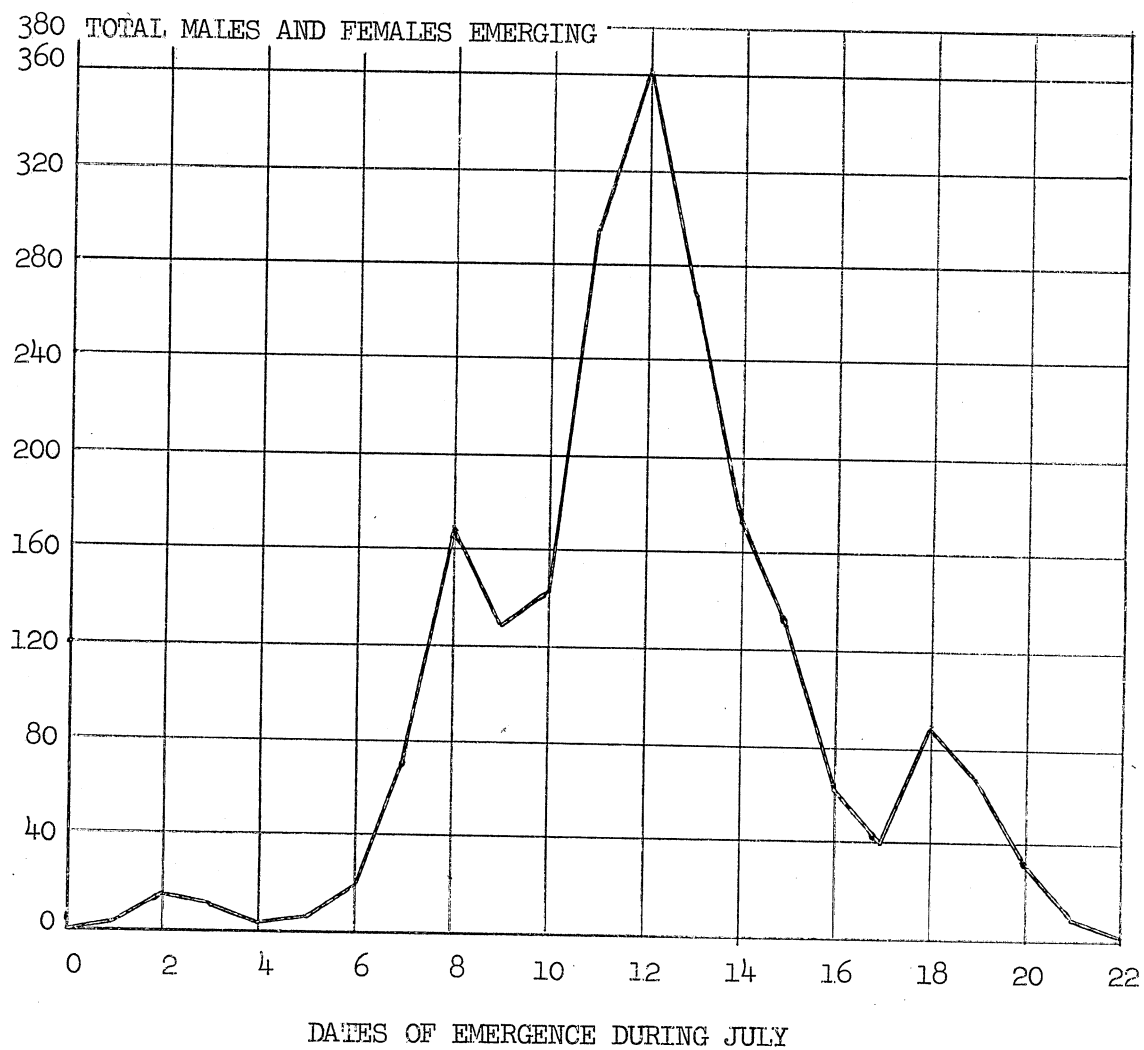
Number of Proctotrupids emerging in July, by dates												Grams of :														
Box No.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	emerge	Total	: rearing :	Emergence
1																	3						3	9.0 g		0.3
2																3	6						10	12.1 g		0.8
3							1											1					8	14.4 g		0.6
4						1	1									1		2	1				10	9.4 g		1.1
5				1					2	1													5	7.8 g		0.6
6						1			4							5		3					16	11.5 g		1.4
7																	1						1	9.5 g		0.1
8							1	1	2							2	6		3				15	10.6 g		1.4
9							1	1	1	1						3	7	12	3				36	10.6 g		3.4
10						2			1	1						5	8	2	2				20	10.5 g		1.9
11								4	1	1						2	2	2	2				15	10.4 g		1.5
12																			4				5	15.6 g		0.3
13					1		1	3	3	1	2	3	9			3		5	9				28	17.3 g		1.6
14							1	1	1	2	1	6						7	11				33	15.3 g		2.2
15									2	1	1	1	1			1				2	5		16	9.0 g		1.8
16							1					2	2			1		3		8	3		18	10.3 g		1.7
Totals	1	2	10	7	18	9	13	25	5	5	5	34	47	40	10	8							239	183.3 g		1.3

Table 3.-Summary of *Aphidoletes thompsoni* released in July, 1957

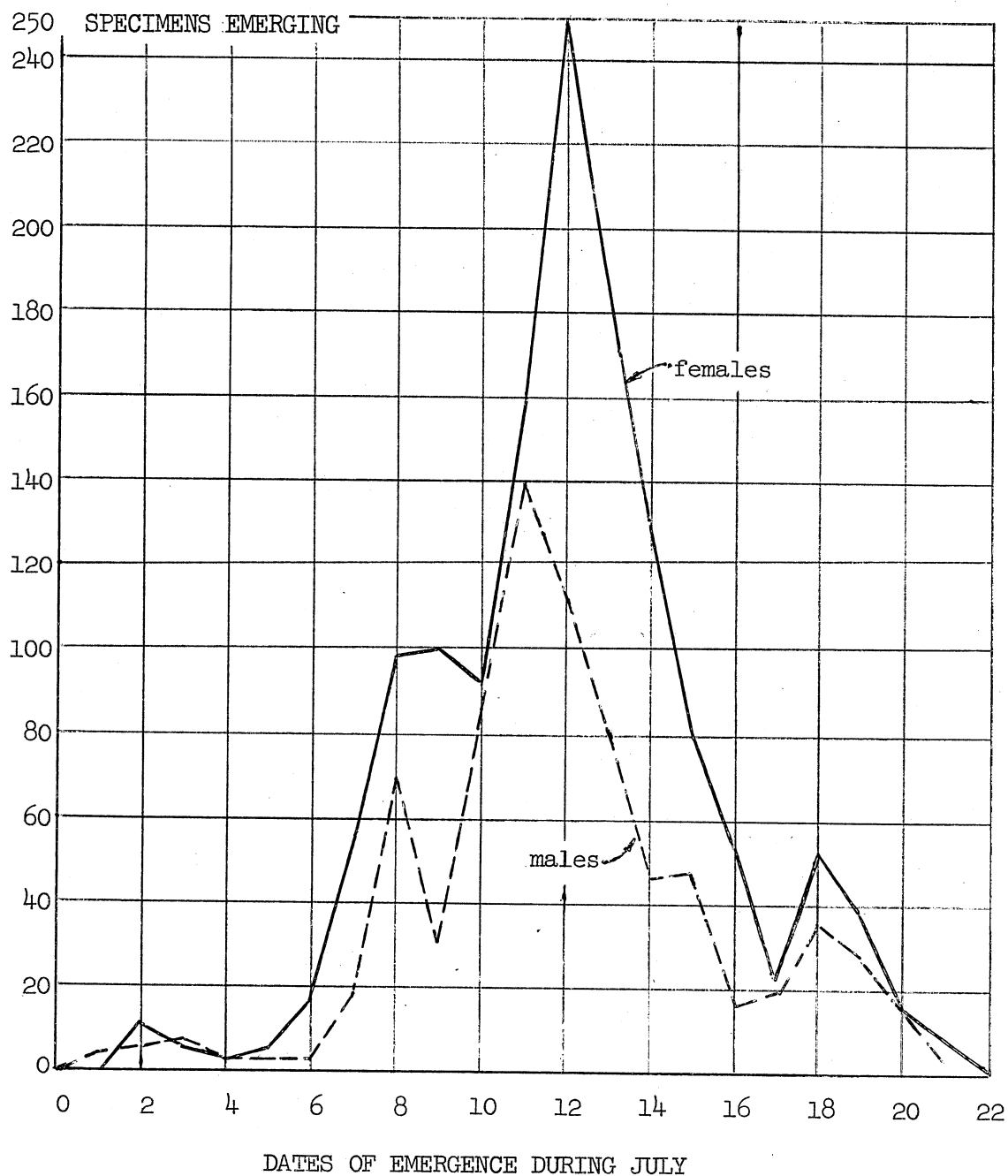
Date and time	Release area	Type of Release	Number Aphidoletes Released :			Weather conditions
			Males	Females	Total	
7/5 : 9 am	Black Rock	Cage	14	14	28	Clear 69° F.
7/8 : 4 pm	Toutle River	Cage	35	72	107	Cloudy 67° F.
7/9 :12 noon	Black Rock	Cage	52	72	124	Part cldy; 62° F.
7/11: 4 pm	Toutle River	Cage	87	150	237	Cloudy 56° F.
7/12: 3 pm	Black Rock	Cage	142	153	295	Clear 72° F.
7/13:12 noon	Corvallis	Cage	68	132	200	Cloudy 72° F.
7/14: 4 pm	Black Rock	Free	112	232	344	v. humid Rainy 52° F.
7/16:10 am	Toutle River	Free	89	172	261	Cloudy 55° F.
7/19:12 noon	Black Rock	Cage	61	100	161	Part cldy; 74° F.
7/23:11 am	Black Rock	Free	34	39	73	Cloudy 57° F.
Totals			694	1136	1830	

Totals by Areas

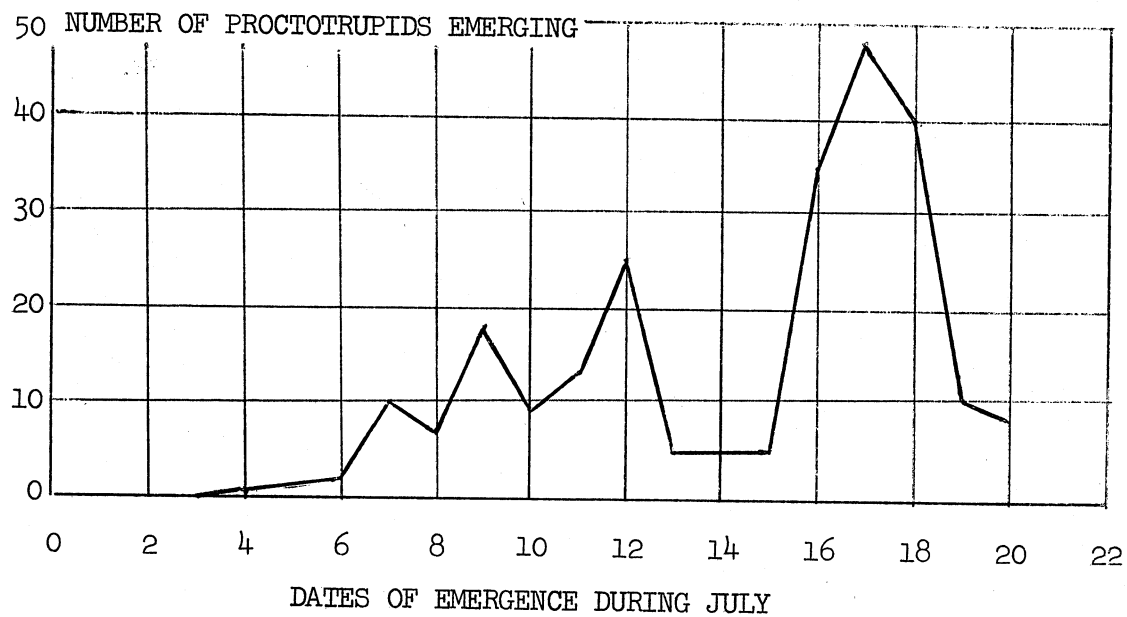
Black Rock	1025
Toutle River	605
Corvallis	200



GRAPH 1. TREND OF TOTAL APHIDOLETES EMERGENCE AT SELLWOOD LABORATORY  
JULY, 1957



GRAPH 2. TREND OF EMERGENCE OF MALE AND FEMALE APHIDOLETES AT SELLWOOD LABORATORY -- JULY, 1957



GRAPH 3. TREND OF EMERGENCE OF PROCTOTRUPID PARASITES OF  
APHIDOLETES THOMPSONI AT SELLWOOD LABORATORY - JULY, 1957

1000

1000

1000